TOWARDS A VERMONT RESILIENCY MATRIX?

VERMONT CLIMATE COUNCIL

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Sources of today's content:

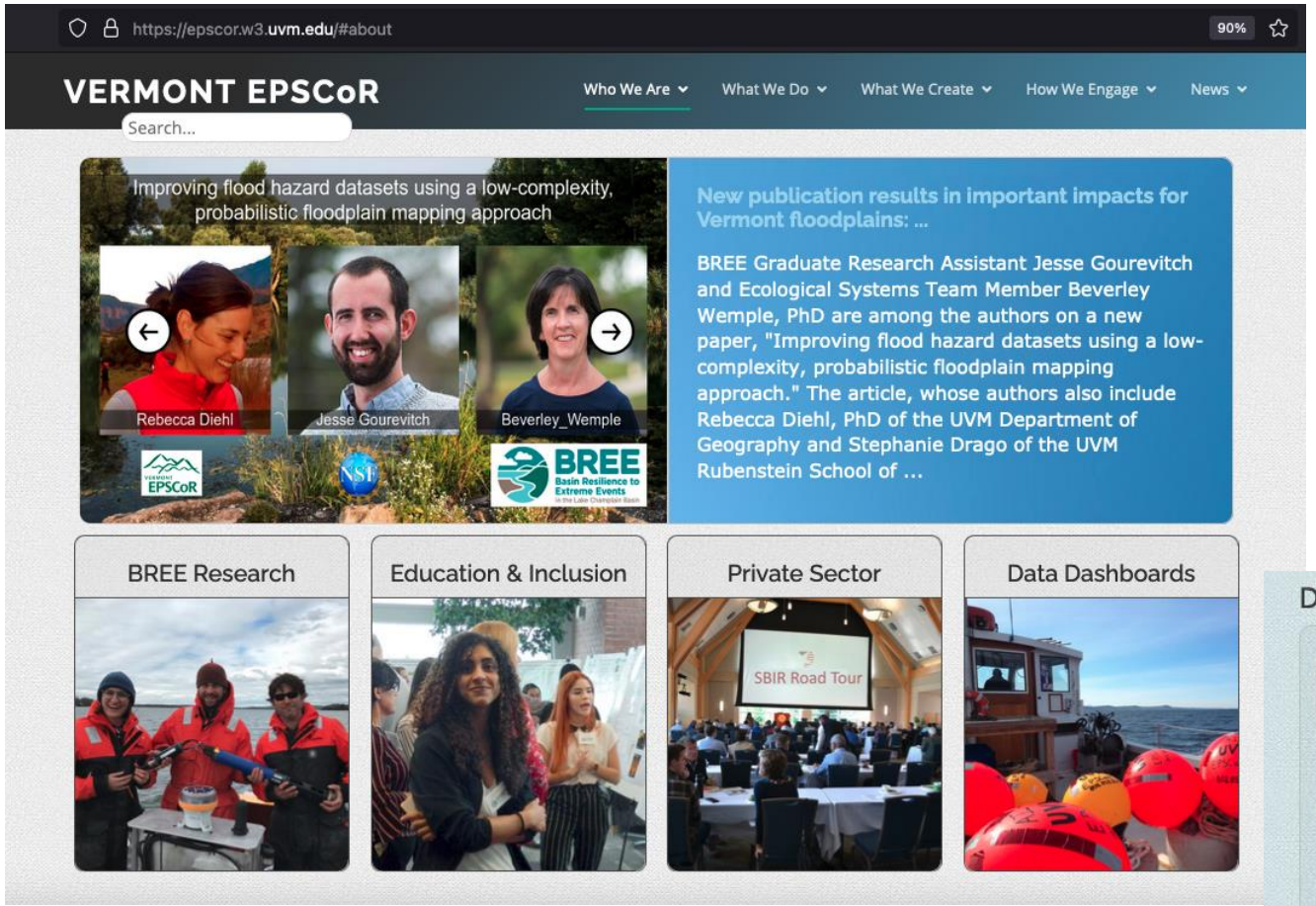
- VT EPSCoR's Research on Adaptation to Climate Change (RACC) and Basin Resilience to Extreme Events (BREE)
- PA 317 Systems Analysis for Community Resiliency / Certificate of Graduate Study in Community Resilience and Planning
- International Joint Commission (ICJ) Lake Champlain Richelieu River Flood Reference
- Economic Resilience Assessment Roundtables

BREE
Basin Resilience to Extreme Events
in the Lake Champlain Basin

CDAE

INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE

THE UNIVERSITY OF VERMONT
OFFICE OF ENGAGEMENT



https://epscor.w3.uvm.edu/#data

UVM St Albans and Missisqoui Bay Platform Data

Image: Missisquoi Bay, July 2020

Saint Albans Bay

Last Platform Collection	June 25, 2021 08:00
STA_Surface Temperature (°C)	20.68
STA_Bottom Temperature (°C)	20.7
STA_Surface Dissolved Oxygen (mg/L)	9.82
STA_Bottom Dissolved Oxygen (mg/L)	9.78
Last Met Collection	June 25, 2021 07:50
Air Temperature (°C)	18.89
Wind Speed (m/s)	5.54
Wind Speed (mph)	12.39
Wind Direction	SE

Missisquoi Bay

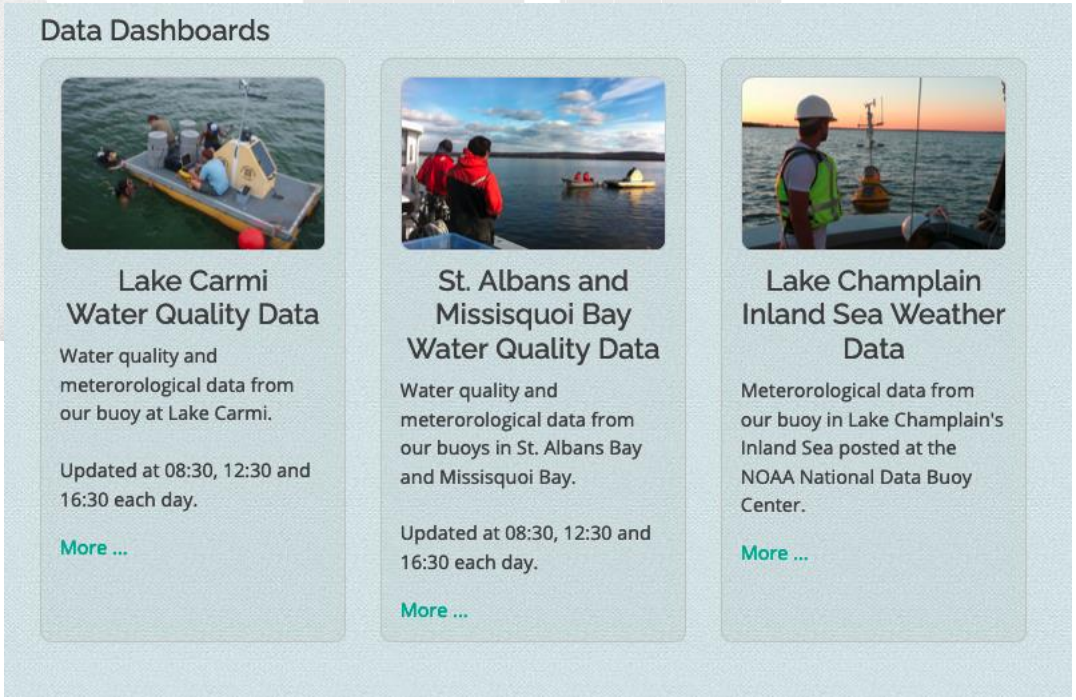
Last Platform Collection	June 23, 2021 03:00
MB_Surface Temperature (°C)	21.19
MB_Bottom Temperature (°C)	21.182
MB_Surface Dissolved Oxygen (mg/L)	8.72
MB_Bottom Dissolved Oxygen (mg/L)	8.71
Last Met Collection	June 25, 2021 08:00
Air Temperature (°C)	19.6
Wind Speed (m/s)	5.03
Wind Speed (mph)	11.25
Wind Direction	SSE

2021 Lake Condition Plots

Note: click the legend to isolate desired depths for a cleaner look.

Saint Albans Bay Dissolved Oxygen

Missisquoi Bay Dissolved Oxygen

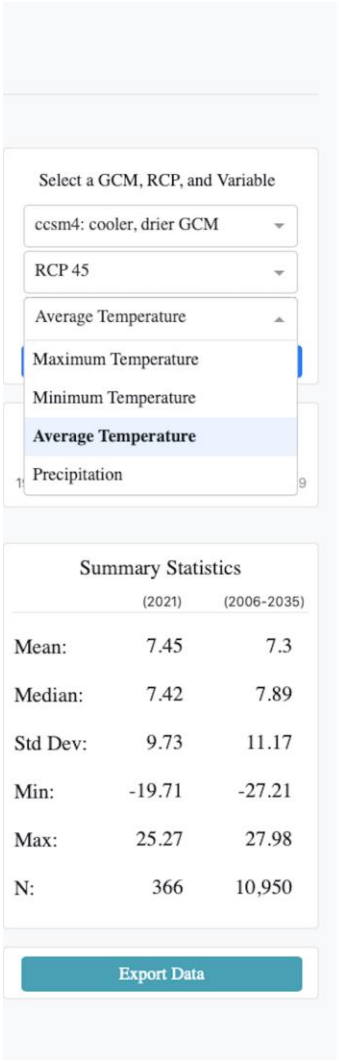


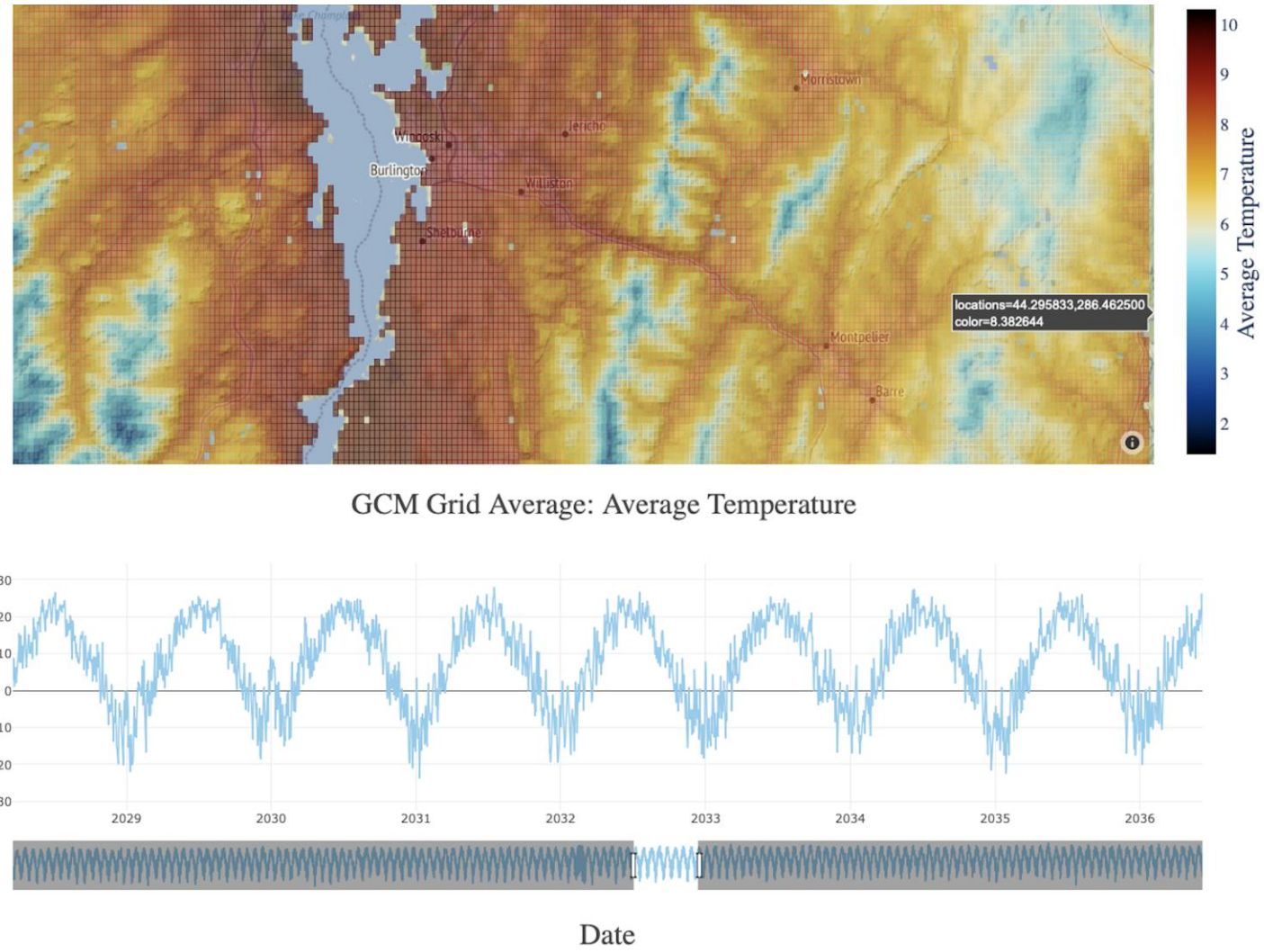
Regional Downscaled Climate Model Dashboard – under construction

Sliders:

- GCMs
- RCPs

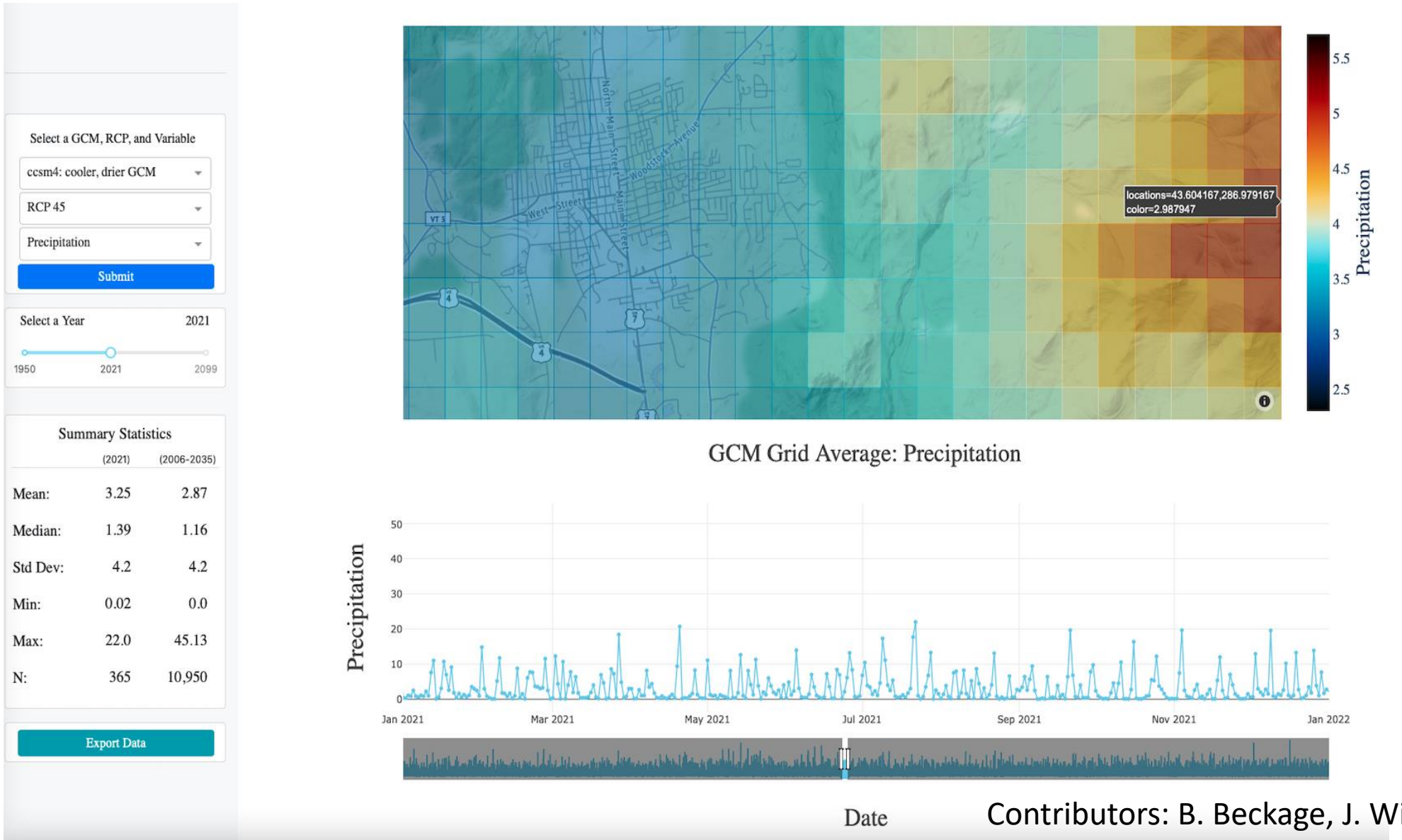
- Temperature
- Precipitation





Contributors: B. Beckage, J. Winter, P.Clemins, E. Clark

Regional Downscaled Climate Model Dashboard – under construction



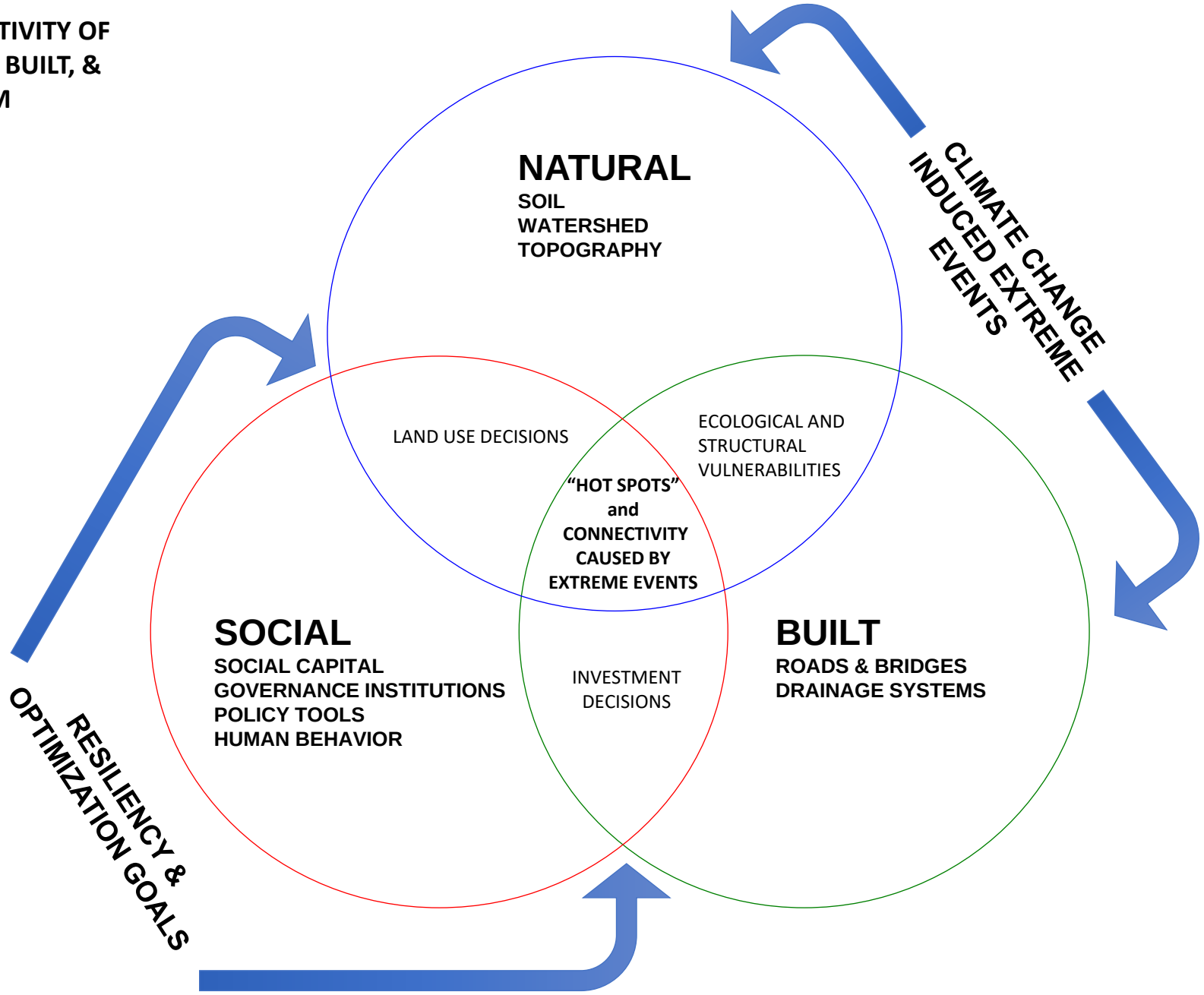
- Days above 90 degrees F
- First/last frost
- Drought indices

Contributors: B. Beckage, J. Winter, P.Clemins, E. Clark

What is resilient?

- Resilient ecosystems
- Resilient people
- Resilient places (rural, urban, social ecological systems)
- Resilient things (infrastructure)
- Resilient organizations and institutions (governments, NGOs, businesses)
- Resilient communities

INTERCONNECTIVITY OF THE NATURAL, BUILT, & SOCIAL SYSTEM

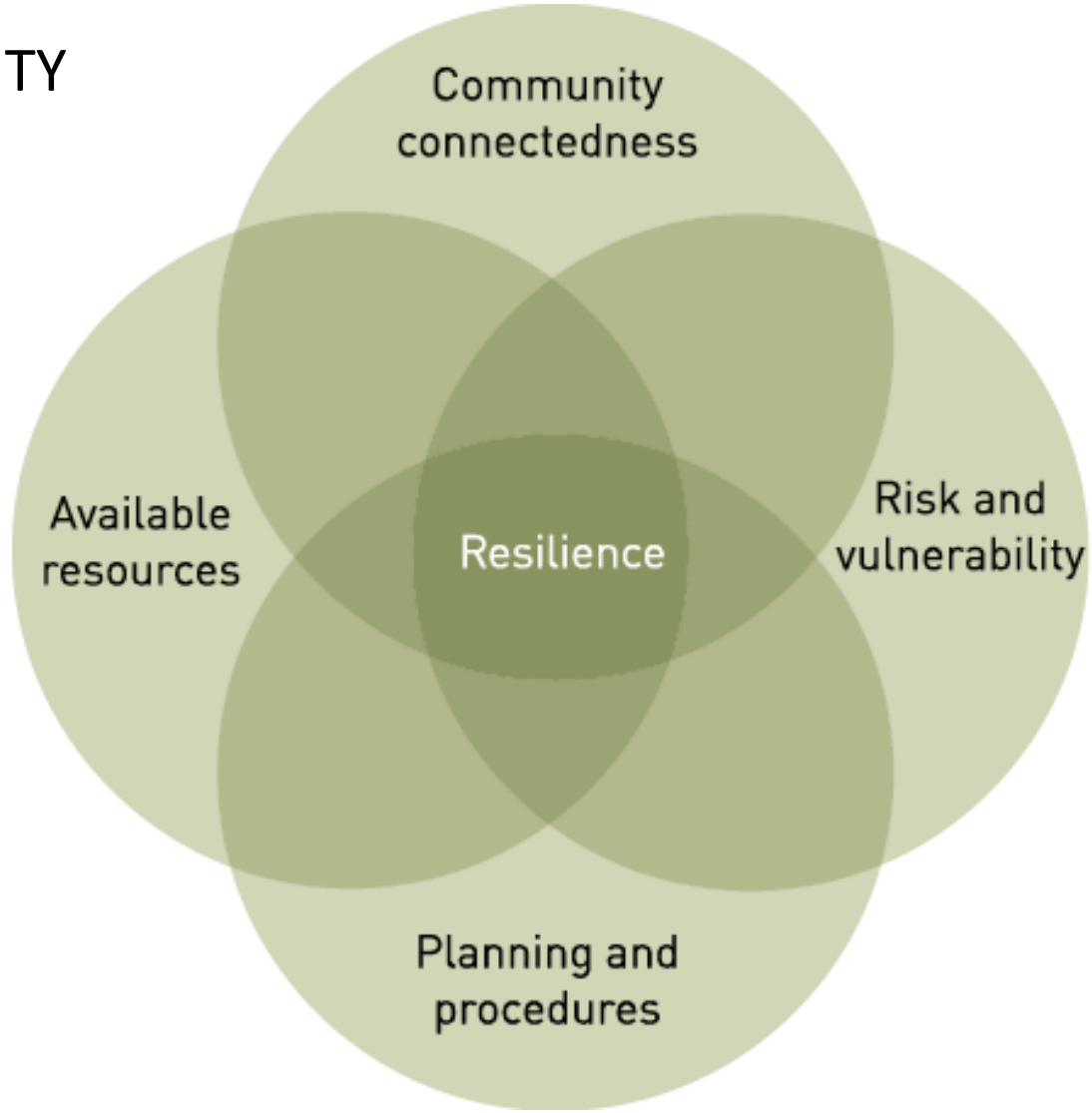


What does it mean to be resilient? (it's a tricky question)

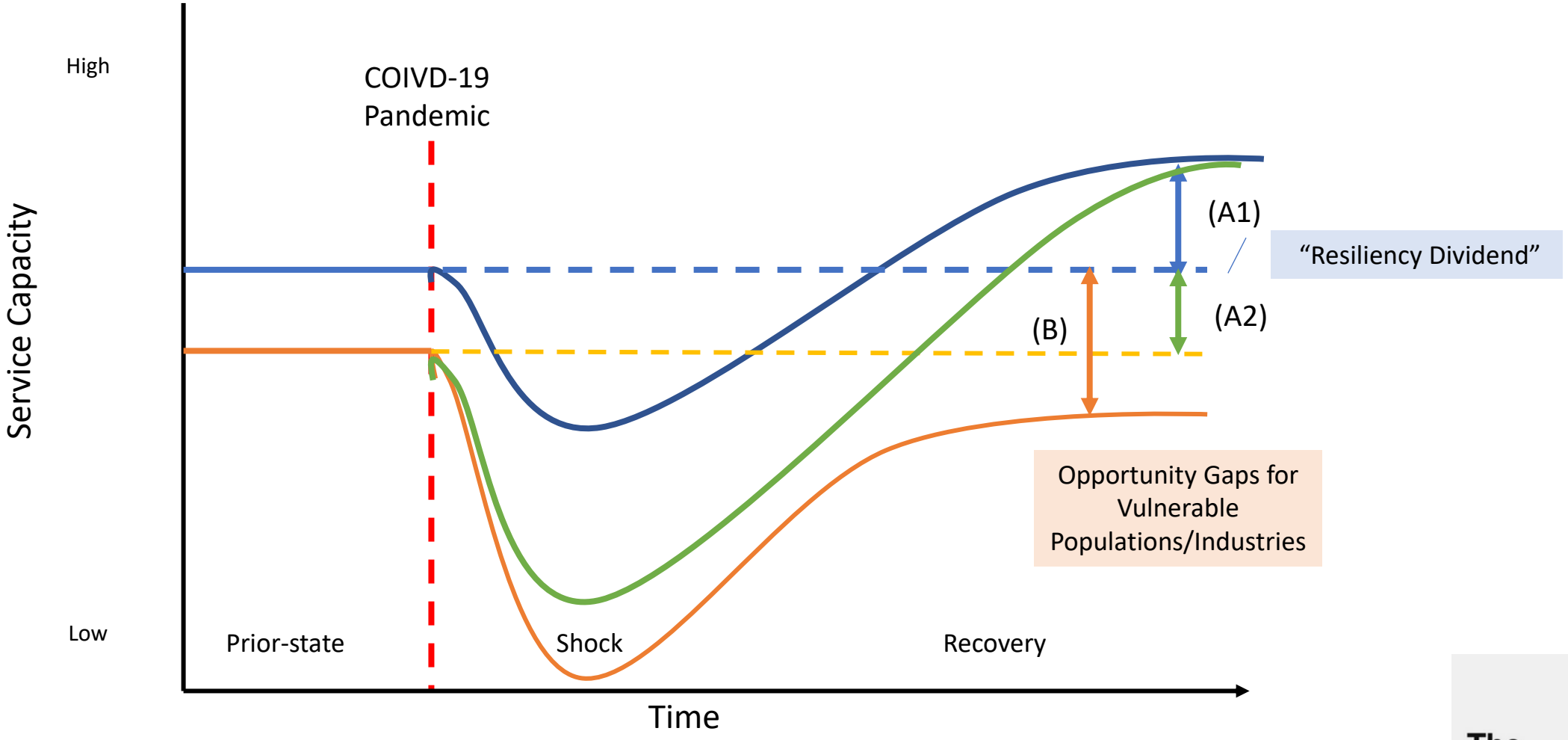
Ecological	• "... the capacity of a system to experience shocks while **retaining essentially the same function**, structure, feedbacks, and therefore identity"
Social-ecological	• "...the ability of a system to **cope** with a disturbance, **responding**, or **reorganizing** to anticipated or past events..."
Disaster	• "... the measure of a system's, or part of a system's, capacity to **absorb** and **recover** from the occurrence of a hazardous event"
Urban	• "... the ability of a city or urban system to **withstand** a wide array of shocks and stresses, and return to normal..."
Community	• "... the existence, development and engagement of community resources by community members to thrive in an environment characterized by change, **uncertainty**, unpredictability and **surprise**"

Davidson, J., C. Jacobson, A. Lyth, A. Dedekorkut-Howes, C. Baldwin, J. Ellison, N. Holbrook, M. Howes, S. Serrao-Neumann, L. Singh-Peterson, and T. Smith. 2016. Interrogating resilience: toward a typology to improve its operationalization. *Ecology and Society* 21 (2):27.

ELEMENTS OF RESILENCY CAPACITY BUILDING



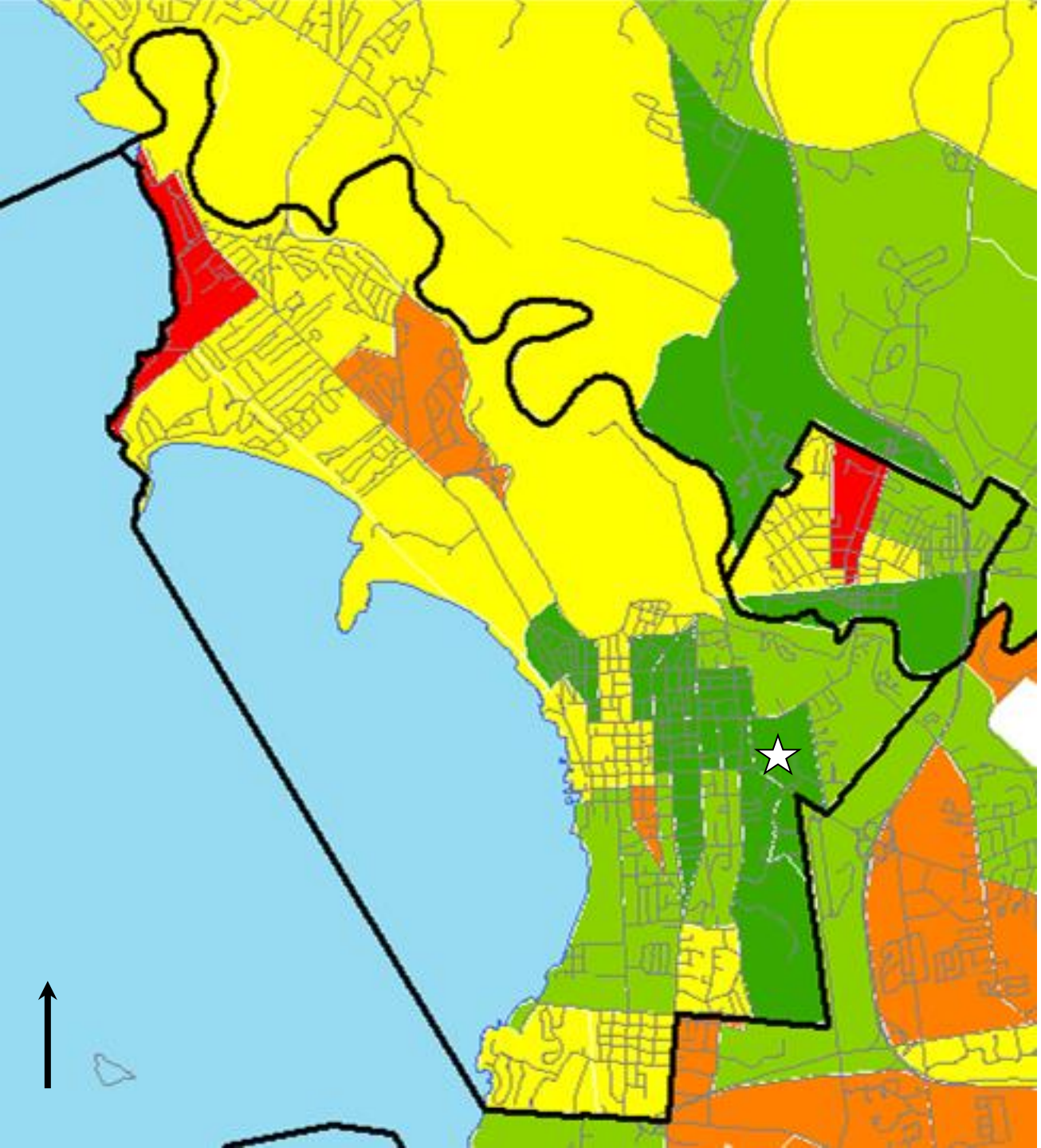
THE COMMUNITY RESILIENCY RECOVERY CURVE(S)



The K-Shaped Recovery

Social Vulnerability

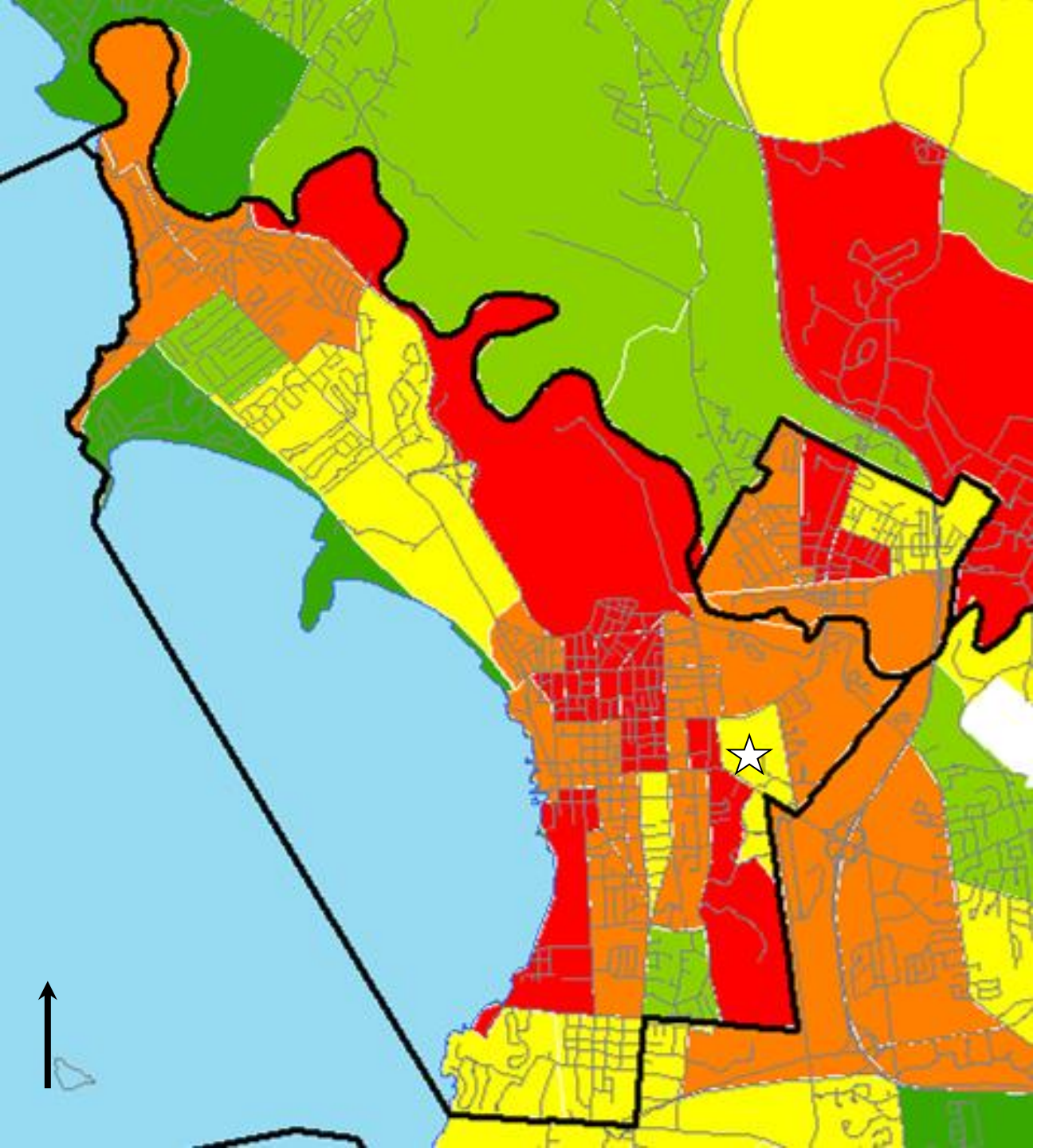
- Part of understanding resilience/absorptive capacity of a community
  - Geospatial analysis of census data
- Helps to target resources to areas of greatest impact
- Social vulnerability indicators
  - Social Sensibility Score
    - Sensitive populations
    - Precarious situation
    - Limited Resources



City of Burlington, VT

- Sensitive populations
  - Vulnerable age groups
  - Percentage of households that have children
  - Individuals inactive in labor market
  - Individuals living alone
- Useful for flood hazards
  - <u>In the response phase</u>

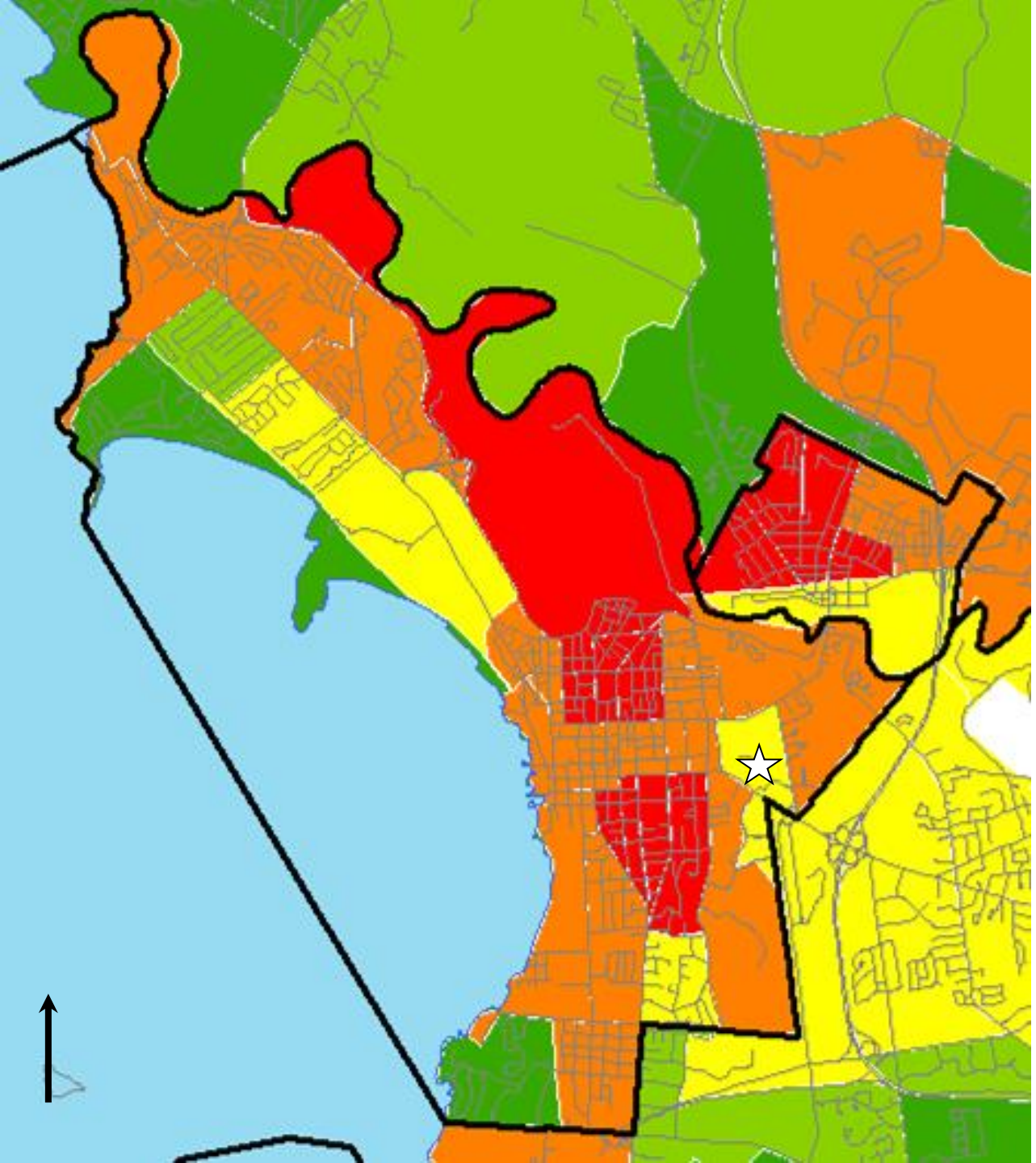
SOURCE: Thayer, 2020



City of Burlington, VT

- Precarious situations
  - Single parent families
  - Rental/tenant status households
  - Households spending >30% of income on housing costs
  - Households with <$30,000 annual income
  - Unemployment rate
- Useful for flood hazards
  - <u>In the recovery phase</u>

SOURCE: Thayer, 2020



City of Burlington, VT

- Limited Resources
  - Houses built prior to 1960
  - Percentage of individuals 25+ without a high school diploma
  - Percentage of households receiving social assistance
  - Median value of housing
  - Median household income

- Useful for flood hazards
  - <u>In the mitigation phase</u>

SOURCE: Thayer, 2020

LCRR BASIN FLOOD HAZARD SOCIAL-ECOLOGICAL SYSTEM

Individuals

Institutions

Preferences: Decision Criteria

Preferences: Decision Criteria

SOCIAL, POLITICAL & ECONOMIC SYSTEM

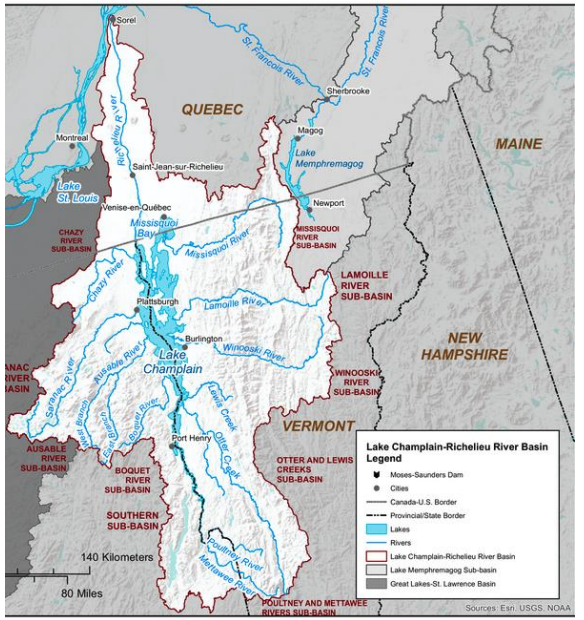
FLOOD MITIGATION

THEME 1: Structural

THEME 2: Wetland preservation

THEME 4: Policy tools (land use; insurance)

THEME 4: Flood Maps, Models and Simulations

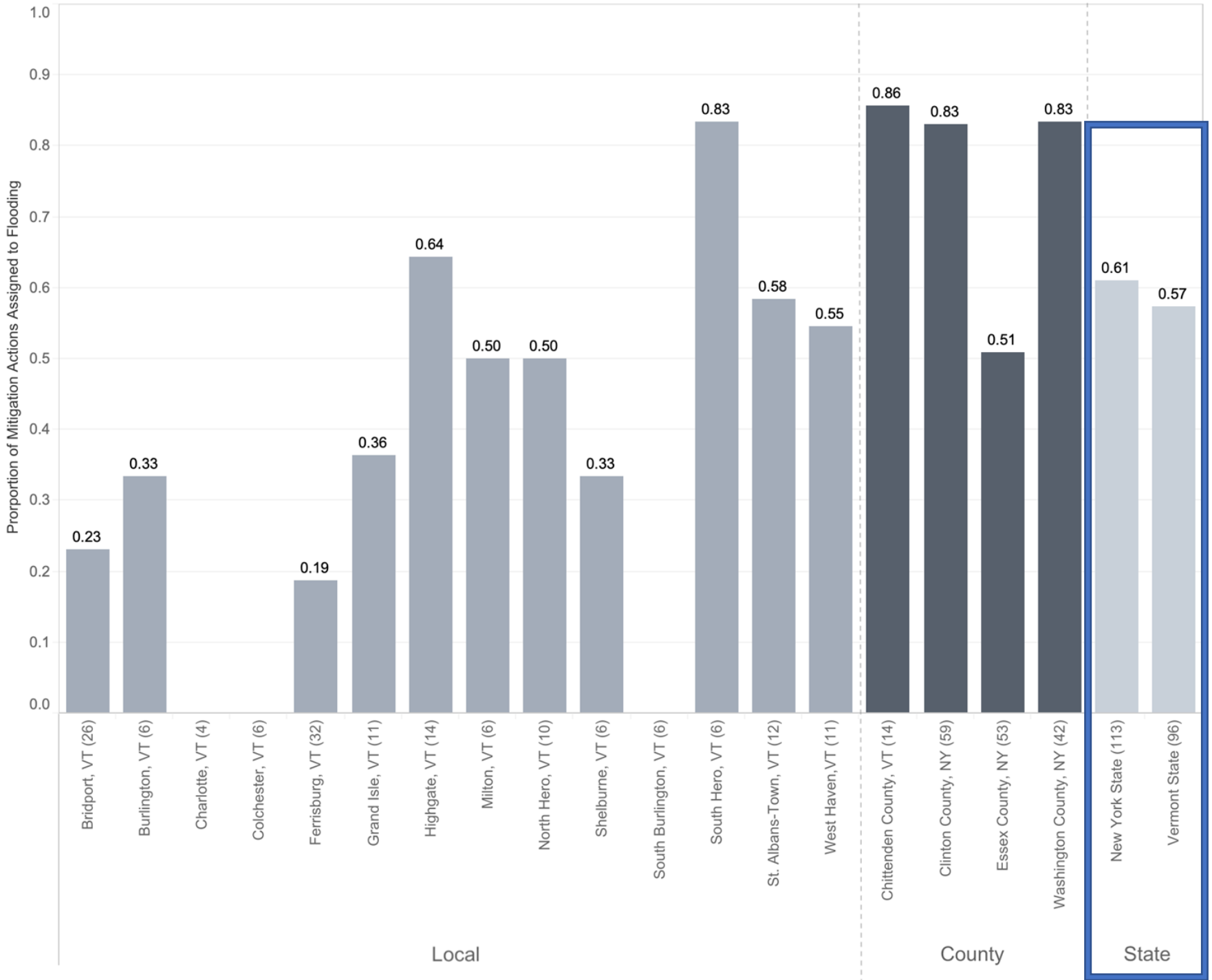


HYDRO-ECOLOGICAL SYSTEM

THEME 3: Forecasts / Early Warning

THEME 3: Coordinated responses

FLOOD RESPONSE & RECOVERY



Frequency of Flood Hazard Mitigation Measures

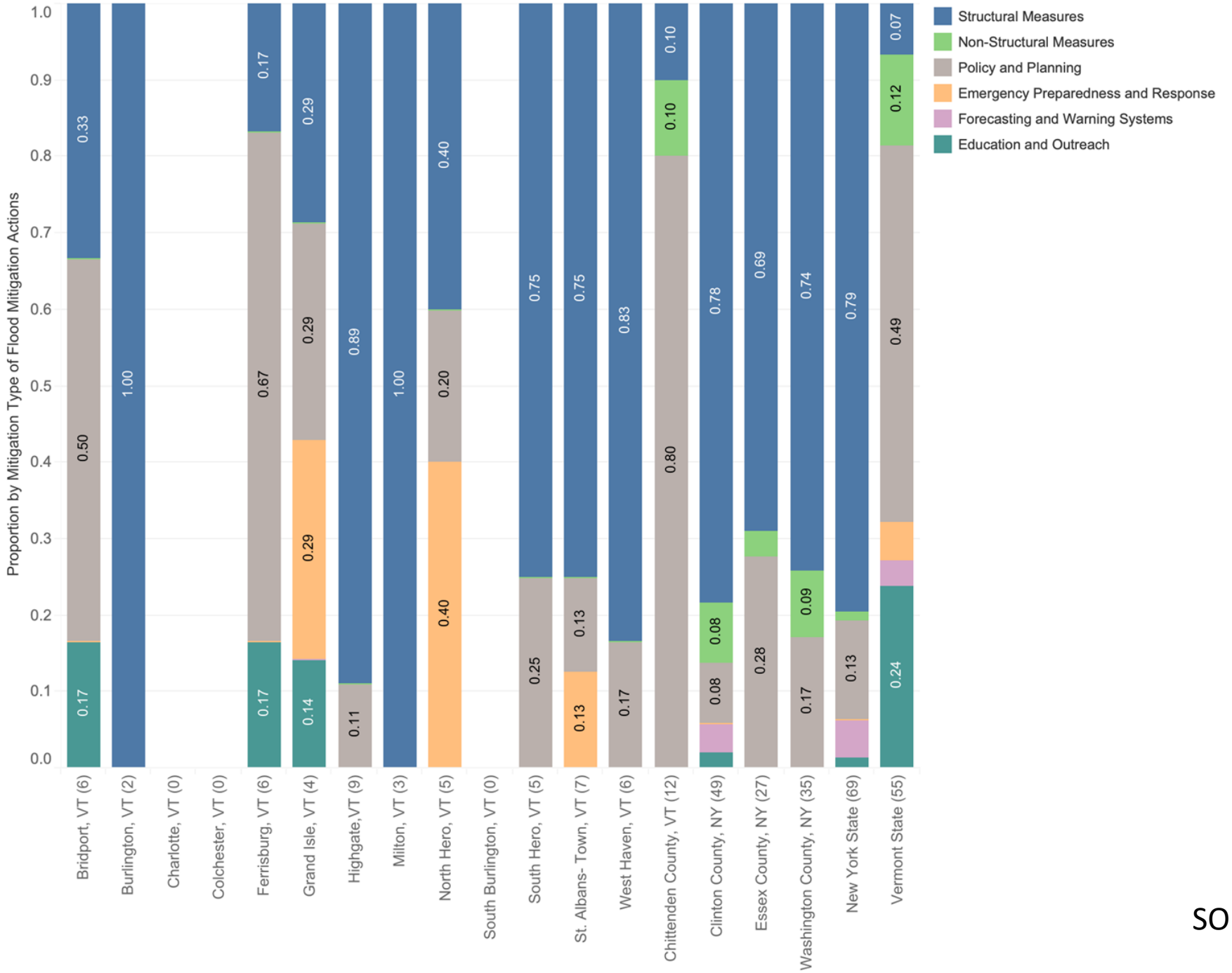
In VT and NY State Hazard Mitigation Plans

&

In Lake Champlain Adjacent VT Towns & NY Counties

SOURCE: Thayer, 2020

Type of Approach of Flood Mitigation Actions



SOURCE: Thayer, 2020

Why Resilient *Rural* Communities?

- We invest in rural America to protect and restore the environment.
- We invest in rural America to produce high-quality, de-commodified food and fiber.
- We invest in rural America as a laboratory of social innovation.
- We invest in rural America to produce healthy, well-educated future citizens.
- We invest in rural America to maintain population distribution and prevent urban overcrowding. (Stauber, 2001, P.60)

ECONOMIC RESILIENCY ROUNDTABLES

Sentiments of professionals working in organizations and sectors with a mission of enhancing economic and entrepreneurship development, workforce development, the interests of BIPOC Vermonters, public and private finance, arts & culture, government, social services, planning, arts and culture, or education and research.

Participants were recruited to a 90-minute meetings. N= 75 participants

Goals and Questions of Roundtables

1. Defining Success

Observation:

There is a "Vermont way" of defining successful community economic development.

Research Questions:

- What is the relationship between economic impact and other indicators of community health and well-being?
- What performance metrics should guide strategic investments?

1.2 Helping Vermont's rural economy compete in a post-pandemic world

Observation:

Vermont is one of the most rural states with regions that are struggling to build a thriving economy after the pandemic.

Research Questions:

- What are the highest priority post-pandemic economic and community development initiatives?
- How can rural Vermont innovate economic development efforts to accelerate recovery?
- How has the pandemic highlighted emerging needs and opportunities?

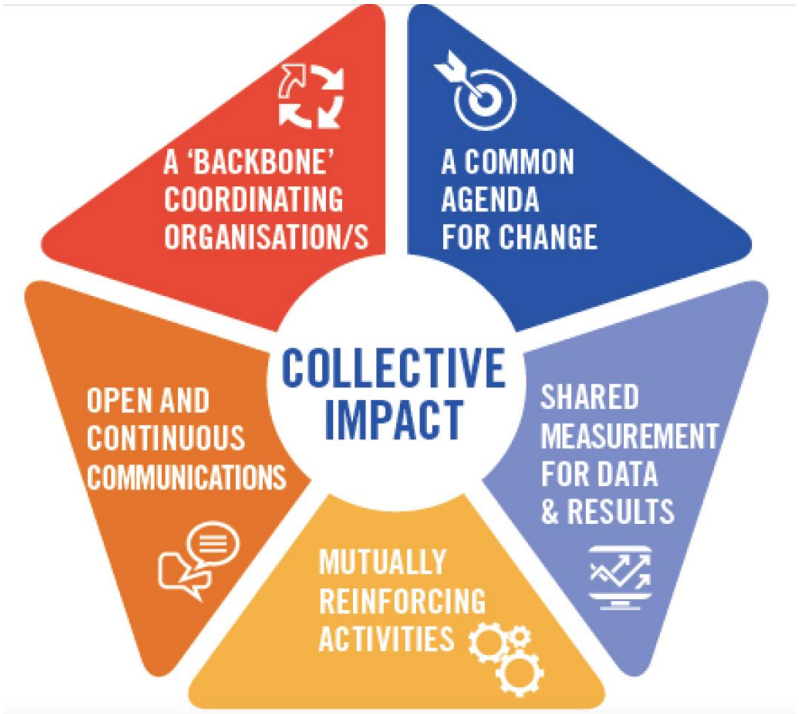
ROUNDTABLE RESULTS: Key Challenges

Lack of Adequate Workforce Leads to High Levels of Job Vacancies	*Lack of Social Equity, Cultural Diversity, and Inclusivity Stifles Economic Development and Innovation*	*Low Levels of Public and Private Investment, Levels of Risk and Patient Capital within Rural Communities Challenges Innovation*	*Poor Broadband Access Hinders Vermonters' Abilities to Work and Learn from Home, and Limits the Capacities of Small Rural Businesses*	*Educational Systems are Not Sufficiently Designed for Preparing Young People to Find Meaningful and Well-Paying Career Pathways*
Cost of Universal Early Childcare and Preschool Places Burdens on Working Parents, and Provides Inequitable Starts for Young Vermonters	*The Emerging "Digital Economy" is Leaving Rural Communities Behind*	*Chronically Poor Housing and Commercial Property Availability Limits Population Growth and Creates Inequitable Access to Affordable Housing*	*Lacking and/or Aging Infrastructure for Town Centers Serves as a Limiting Factor for Sustainable Growth*	*Threatened Working Landscapes and Waterways Compromises One of Vermont's Greatest Virtues*
Vermont's Aging Rural Population	*Lack of Access to Healthcare and Poor Health Outcomes for Rural Communities and Low-Income Households*	*High Transportation Costs and Inadequate Public Transportation Infrastructure Hamper Vermont's Affordability*	*High Economic and Environmental Costs of Heating and Cooling Hamper Vermont's Affordability*	*Gaps in Coordination and Governance Built to Address Prior Conditions Are Not Well Suited to Address Existing Conditions*

ROUNDTABLE RESULTS: Key Opportunities

- Invest in a Skilled Workforce
- Focus on Racial Equity, and Building Inclusion and Belonging Communities
- Build Investments for Entrepreneurial Enterprises
- **Promote and Sustain a Remote Workforce While Maintaining Thriving Town Centers**
- **Leverage Vermont's Quality of Life as a Critical Feature in Jobs Attraction**
- Appreciate the Role of the Nonprofit Sector as a Critical Feature of the Vermont Economy
- Invest in Childcare, Preschool, and Education
- **Invest in Broadband, Housing, Transportation, Water, and Energy Infrastructure**
- **Pursue a Collective Impact Approach to Economic and Workforce Development Rooted in Social Equity**

Toward a Collective Action Approach to Community Economic Resiliency



Cultivating communication flows

- *Communications Hub of Information Regarding the Challenges and Opportunities Facing Vermont.*

Common Agendas

- *Collect and Develop Common Cross Sector and Multi-Scale Agendas*

Shared Metrics

- *Develop a Set of Performance Measures to Track and Triangulate—Generated for State, Regional and Local Scales*

THIS CAN AID IN IMPLEMENTING PATHWAY #2

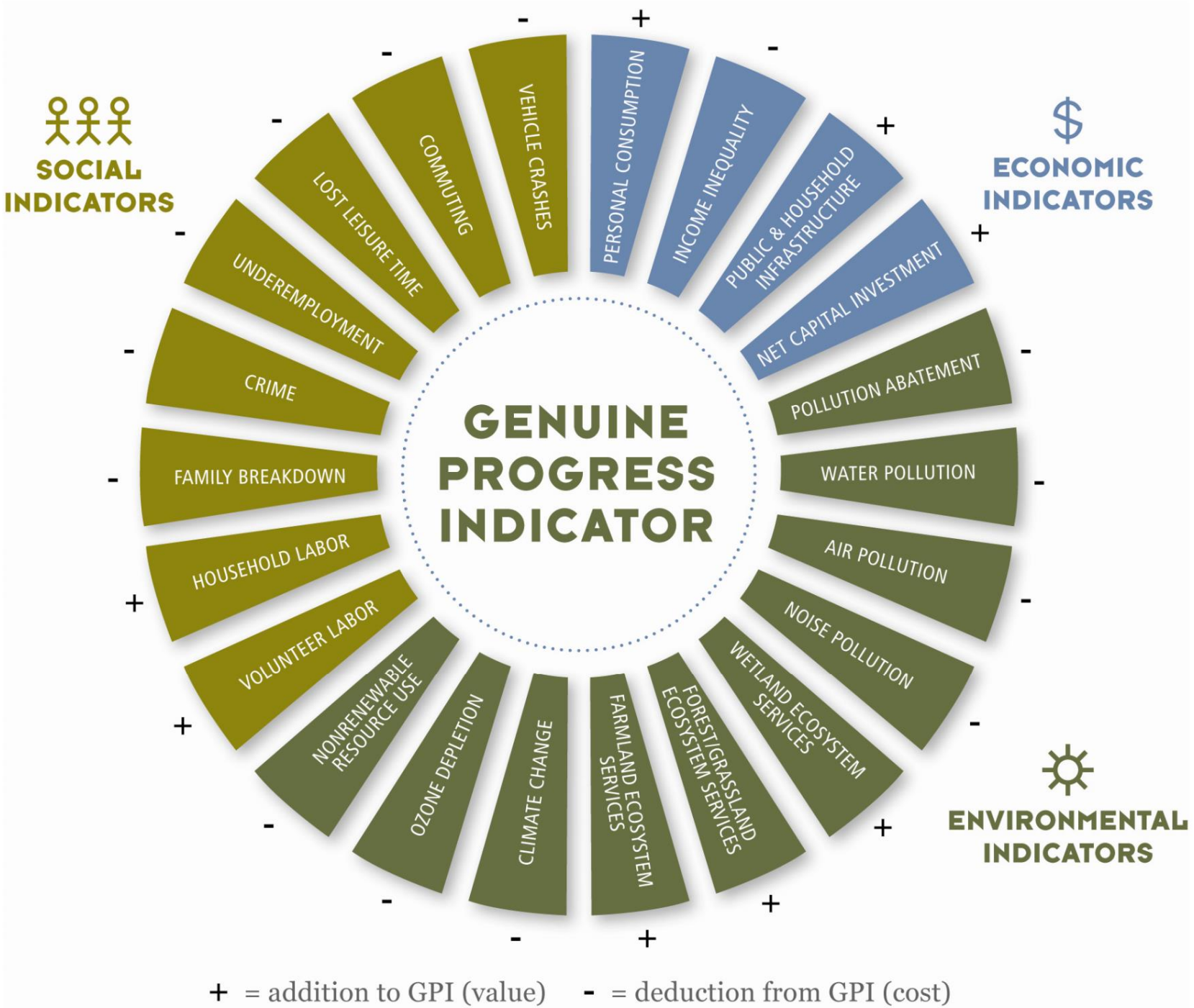
Robust Infrastructure

- *Develop an Integrated Data and Research Infrastructure for Community Economic Development*
- *Clarify and Empower the State's Convening and Facilitation Infrastructure*
- *Codify a Coordinated Funding Infrastructure*

Mutually Reinforcing Activities

THIS IS YOUR META-SOLUTION FOR PATHWAY #1

SUSTAINABLE DEVELOPMENT GOALS


SOCIAL INDICATORS
ECONOMIC INDICATORS
ENVIRONMENTAL INDICATORS
GENUINE PROGRESS INDICATOR
VEHICLE CRASHES
COMMUTING
LOST LEISURE TIME
UNDEREMPLOYMENT
CRIME
FAMILY BREAKDOWN
HOUSEHOLD LABOR
VOLUNTEER LABOR
NONRENEWABLE RESOURCE USE
OZONE DEPLETION
CLIMATE CHANGE
FARMLAND ECOSYSTEM SERVICES
FOREST/GRASSLAND ECOSYSTEM SERVICES
WETLAND ECOSYSTEM SERVICES
NOISE POLLUTION
AIR POLLUTION
WATER POLLUTION
POLLUTION ABATEMENT
NET CAPITAL INVESTMENT
PUBLIC & HOUSEHOLD INFRASTRUCTURE
INCOME INEQUALITY
PERSONAL CONSUMPTION
+ = addition to GPI (value)
- = deduction from GPI (cost)

Nebraska regions also are compared with peers on five indexes of economic conditions:

Demographic Growth & Renewal Index

Measures long-run population growth, dependency ratio, median age, millennial and Gen Z balance change and population diversity. See Table 4 on page 9 and Appendix 4 online.

Education & Skill Index

Measures high school, community college and 4-year college attainment, labor force participation and employment in knowledge-based occupations. See Table 5 on page 10 and Appendix 5 online.

Infrastructure & Cost of Doing Business Index

Measures access to broadband, interstate highways and 4-year colleges as well as wage rates, marginal income tax rates and the presence of opportunity zones. See Table 6 on page 10 and Appendix 6 online.

Quality of Life Index

Measures the appeal of living and working in a region including commute times, age of housing stock, relative wage rates, public safety, climate amenities, access to healthcare and national parks. See Table 7 on page 11 and Appendix 7 online.

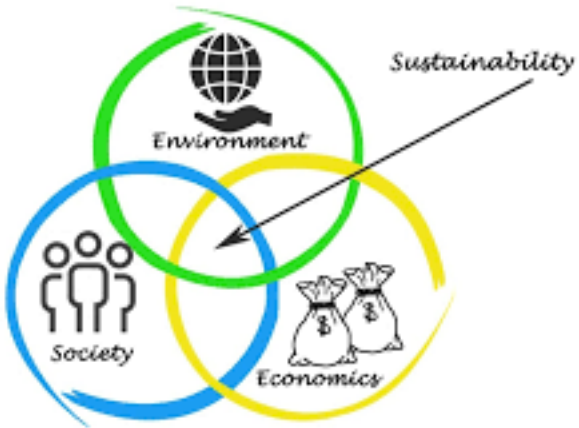
Social Capital Index

Measures involvement with volunteer organizations, programs to build the community environment, and voter participation. See Table 8 on page 11 and Appendix 8 online.

Table I Multifunctionality and global indicators (selection) of well- and poorly developed economic, social and environmental capital

		Strongly developed capital	*Weakly developed capital*
Multifunctionality of rural communities	Economic capital	• Economic well-being • Diversified income streams (e.g. pluriactivity) • Low dependency on external funds (e.g. agricultural subsidies) • Multifunctional businesses • Integration into global capitalist system (?) • Happiness (?) • etc.	• Poverty/debt • Over-dependency on agricultural production • Poor infrastructure • High dependency on external funding (e.g. subsidies; remittances from abroad) (?) • Communities as net importers of food • etc.
	Social capital	• Close interaction between rural people (tight-knit communities) • Availability of skills training and education • Good health and sanitation • Multifunctional services • Good communication between stakeholder groups • Female empowerment/empower ment of ethnic minorities in rural areas (?) • Open-minded communities (ability to accept change) • Good and transparent land owner ship regulations (control over means of production) • Rural stakeholders in control of development trajectories • Strong governance structures at multiple geographical scales (democratic participation) • etc.	• Outmigration of young people (greying of rural communities) • Service deserts • Lack of leadership • Lack of control over destiny of rural community • High death rates and low life expectancy • Poor communication between stake holder groups • Female dependency/gender- or ethnically-based lack of self-determination • Weak land ownership patterns (e.g. high levels of tenant/ dependent farmers) • General dissatisfaction with rural community pathways • Weak governance • etc.
	Environmental capital	• High levels of biodiversity • Good water quality and availability • Sustainable soil management • Predictable agricultural yields • Sustainable management of envi ronmental resources in rural community • Multifunctional environmental resources • etc.	• Soil degradation • Desertification • Salinization • Poor water quality and availability • Uncertainty over agricultural yields • etc.

Source: author; after Pretty (1995); Parnwell (2007); Van Huylenbroek *et al.* (2007); Noe *et al.* (2008); Chaskin (2008); Cutter *et al.* (2008); Rigg *et al.* (2008).



(Wilson, 2012)

Considerations:

Is there an interest/desire to develop a Vermont resiliency matrix?

A collective impact approach to CC resiliency?